

# Weight of the Evidence or Wait for the Evidence?

## Protecting Underground Miners From Diesel Particulate Matter

A coalition of mine operators has used a variety of tactics to obstruct scientific inquiry and impede public health action designed to protect underground miners from diesel particulate matter. These workers are exposed to the highest level of diesel particulate matter compared with any other occupational group.

This case study profiles a decade-long saga of the Methane Awareness Resource Group Diesel Coalition to impede epidemiological studies on diesel exhaust undertaken by the National Institute for Occupational Safety and Health and the National Cancer Institute, and to derail a health standard promulgated by the Mine Safety and Health Administration. The case study highlights the coalition's mastery of legislative, judicial, and executive branch operations and the reaction of policymakers. (*Am J Public Health*. 2006;96:271–276. doi:10.2105/AJPH.2005.064410)

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**AT MANY US UNDERGROUND** metal and nonmetal mines, the equipment needed to extract the limestone, gold, silver, salt, or other ore is powered by diesel engines. For the 18 000 miners who work in this confined underground world, exposure to diesel exhaust and particulate matter is just part of the job. They work in poorly ventilated environments, and traditionally this industry has relied on dated, highly polluting engines.

Exposed miners complain about acute health effects from the high levels of diesel exhaust, such as headaches and flulike symptoms. According to 1 miner, "Some of the stresses you can feel—you don't need a gauge to measure this—your burning eyes, nose, throat, your chest irritation. The more you're exposed to, the higher this goes."<sup>1</sup> There are about 200 of these underground metal and nonmetal mines in the United States, located in 30 states.<sup>2</sup> The vast majority of the workers are not represented by a labor organization.<sup>3</sup>

The emissions from diesel engines are a complex mixture of compounds containing gaseous and solid (particulate) fractions. Diesel particulate matter (DPM) is less than 1  $\mu\text{m}$  in diameter, small enough to penetrate deep into the lungs.<sup>4</sup> DPM contains a carbon core and a surface that adsorbs polycyclic aromatic compounds that include many

known carcinogens. The specific composition of the diesel exhaust and the particulate fraction varies depending on the engine type and its maintenance, type of fuel, and exhaust treatment devices.<sup>4</sup>

In an industrial hygiene survey of 27 underground metal and nonmetal mines, the US Department of Labor's Mine Safety and Health Administration (MSHA) recorded 8-hour time-weighted average exposures (i.e., personal exposures) ranging from 100  $\mu\text{g}/\text{m}^3_{\text{TC}}$  (where TC=total carbon) to more than 3500  $\mu\text{g}/\text{m}^3_{\text{TC}}$ .<sup>5,6</sup> Samples collected in different production areas of the mine (i.e., area samples) revealed similar results.<sup>5</sup> The mean full-shift exposure in the production area of these 27 mines was 808  $\mu\text{g}/\text{m}^3_{\text{TC}}$ .<sup>7</sup> In comparison, in 12 southern California communities, mean annual average exposures to particulate matter less than 2.5  $\mu\text{m}$  in diameter ranged from 5 to 30  $\mu\text{g}/\text{m}^3$ .<sup>8</sup>

A variety of adverse health effects are associated with exposure to diesel exhaust and particulate matter, from acute short-term effects to cancer and cardiovascular and cardiopulmonary disease. The evidence for excess risk of lung cancer includes studies of railroad workers,<sup>9,10</sup> workers in the trucking industry,<sup>11–13</sup> and other workers exposed to diesel emissions.<sup>14,15</sup> The evidence linking exposure to diesel exhaust and particulate matter to

adverse health effects continues to mount.<sup>16–20</sup>

### SCIENTIFIC EVIDENCE PROMPTS FEDERAL AGENCIES TO ACT

In 1988, the US Department of Health and Human Services' National Institute for Occupational Safety and Health (NIOSH) recommended that whole diesel exhaust be regarded as a potential occupational carcinogen.<sup>21</sup> That same year, a MSHA advisory committee issued a report on safety and health concerns related to the use of diesel-powered equipment in underground coal mines (Mine Health Research Advisory Committee. Final report of use of diesel in underground mines. April 30, 1985. Available from author). The report recognized the potential health hazards associated with underground miners' exposure to diesel exhaust but also acknowledged some inadequacies in the exposure and health effects data. Consequently, MSHA asked NIOSH to assist with research and a risk assessment characterizing underground miners' exposure to DPM.<sup>22</sup> In 1992, NIOSH and the National Cancer Institute (NCI) began an analysis to determine the feasibility of an occupational mortality study of workers exposed to diesel exhaust. The study most directly affects metal and nonmetal miners but has value for any workers exposed to diesel exhaust and potentially the general public. The study

proposed a cohort mortality study of underground miners and a nested case-control study of lung cancer. This group of workers was selected because they were exposed to high concentrations of diesel engine exhaust, it was possible to make reasonable estimates of past exposure and control for potential confounding variables, and the cohort was large enough to achieve adequate statistical power. With some modifications, NIOSH and NCI determined the study would be feasible.<sup>23</sup>

## INDUSTRY COALITION OBSTRUCTS NIOSH/NCI STUDY

By 1995, scientists at NCI and NIOSH developed a study protocol and initiated peer review of the protocol.<sup>23</sup> This progress was notable but not necessarily welcome by some mining companies. MSHA had already signaled its intention to regulate miners' exposure to DPM, and the mining allies did not want a government-sponsored study that might add to the mounting evidence of the adverse health effects of DPM. The Methane Awareness Resource Group (MARG) Diesel Coalition,<sup>24</sup> led by attorneys from Patton Boggs LLC, launched their assault on the epidemiological study.

### MARG Strategy 1: Stop the Study Before It Begins

MARG's first attempt to halt the NIOSH/NCI diesel study began with objections to NIOSH's process for peer reviewing the study protocol. MARG argued that NIOSH's peer reviewers were acting as an advisory committee, as defined by the Federal Advisory Committee Act,<sup>25</sup> but

had not been established or administered accordingly. The MARG coalition used this as a reason to file suit in federal court to halt commencement of the study, asserting that the procedural problems compromised the peer review.

MARG also took its allegations to allies in the legislative branch and successfully lobbied to have NIOSH and NCI chastised by lawmakers. In September 1996, the following appeared in a Senate Appropriations Committee Report:

"Concerns have been brought to the attention of the Committee regarding the design of a multiyear study . . . examin[ing] the health effects of diesel fumes on workers in underground noncarbon mines. The Committee . . . urges the Director of NIOSH and the NCI to make certain that the study meets the highest standard of scientific peer review in order to ensure that it provides a definitive answer to the question of whether diesel exhaust adversely affects the health of workers."<sup>26</sup>

To remedy the situation, the NIOSH director transferred responsibility for reviewing the study protocol to a preexisting Federal Advisory Committee Act–authorized committee, the NIOSH's board of scientific counselors. If MARG had a bona fide concern about the legitimacy of the original peer reviewers, the director's action should have resolved it. Instead, MARG amended its legal complaint, questioning the Federal Advisory Committee Act legality of NIOSH's board of scientific counselors.

The district court rejected MARG's claims, but the coalition appealed to the US Court of Appeals for the Fifth Circuit. The higher court upheld most of the district court's decision, except

they agreed with MARG that NIOSH had failed to file the board of scientific counselors' charter with the appropriate congressional oversight committee. The justices noted that

"this seems to have been an understandable mistake. While the House Committee on Commerce has jurisdiction over HHS, the Committee on Education and the Workforce has jurisdiction over NIOSH, and therefore, was the committee where the [board of scientific counselors] charter had to be filed."<sup>27</sup>

The appeals court instructed the district court "to determine an appropriate remedy"<sup>28</sup> for the Department of Health and Human Services' charter-filing mistake.

### MARG Strategy 2: Control the Release of the Study Findings

A legal brief filed by the Department of Health and Human Services offered a straightforward remedy: file the board of scientific counselors charter and documents related to the peer review with the appropriate congressional committee.<sup>29</sup> In contrast, a MARG brief filed in 1999 had a punitive tone, urging the district court to take "strong and meaningful" injunctive relief.<sup>30</sup> MARG's brief also included affidavits the coalition had solicited from congressmen William Goodling (R-Pa) and Cass Ballenger (R-NC), the chairmen of the House Committee and Subcommittee, respectively, with jurisdiction over NIOSH. Their affidavits stated:

" . . . we urge the Court to Order the following actions: (a) immediate and continuous full data disclosure to any interested parties . . . (b) immediate and continuous review of the . . . data generated and draft reports by an independent, non-government group of experts . . . (c) submission of all requested data, and all draft reports, publications and

draft results or risk notification materials to the US House of Representatives Subcommittee on Health and Safety for review and approval prior to finalization and release, and/or publication and distribution" (affidavit of Cass Ballenger, May 4, 1999, and affidavit of William F. Goodling, May 6, 1999 [available from author]).

In March 2000, the district court ordered NIOSH to

"submit to the US House of Representatives Committee on Education and the Workforce all Diesel Study data requested by the Committee, as well as all draft reports, publications, and draft results or risk notification materials prepared in connection with the Diesel Study, for review and approval prior to finalization and release and/or publication and distribution of such materials" [emphasis added] (order by Richard T. Haik, US district judge, March 10, 2000 [available from author]).

Understandably, the Department of Health and Human Services appealed the district court's decision, and the court of appeals agreed that the ruling was too extreme. "The district court's order is tantamount to a use injunction because it authorizes the Committee to prevent the study's publication."<sup>27</sup> They reminded the lower court and the litigants that MARG had received "notice that the [board of scientific counselors] was reviewing the study protocol and were informed of and invited to every meeting of the [board of scientific counselors] panel."<sup>28</sup> The case was remanded to the district court, which amended its order with the following:

"Defendants shall refrain from publicly releasing information submitted to the Committee until 90 days after it is submitted to the Committee" (order by Richard T. Haik, US district judge, June 5, 2001 [available from author]).

This June 2001 court order continues to govern the NIOSH/NCI Diesel Study.

## MARG OPPOSES MSHA DPM RULE

Notwithstanding their efforts to halt the NIOSH/NCI study and then control release of the results, MARG simultaneously attempted to use the pendency of the study as a rationale for halting regulatory action to protect miners' health. In October 1998, MSHA published a proposed rule to protect underground metal and nonmetal miners from DPM.<sup>31</sup> MSHA documented that this population of workers was exposed to extremely high levels of DPM, that the exposures were associated with severe adverse health effects, and that feasible controls (e.g., low-sulfur fuels, routine engine maintenance, particulate filters, modern engines, and ventilation) were available to protect miners' health.

Health standards promulgated by MSHA, like its sister agency the Occupational Safety and Health Administration (OSHA), must "adequately assure on the basis of the best available evidence that no miner will suffer material impairment of health or functional capacity . . . even if such miner has regular exposure . . . for the period of his working lifetime"<sup>32</sup> [emphasis added]. The architects of these laws clearly recognized that scientific knowledge is forever evolving and new information is always on the horizon. These statutes demand action by MSHA and OSHA to protect workers' health when credible evidence of harm exists, even if the exact nature or magnitude of the harm is not fully understood.<sup>33</sup>

For the most part, mining industry representatives opposed the health standard proposed by MSHA. They argued that the scientific evidence justifying the rule was incomplete and accused the agency of acting prematurely. The mining industry representatives often referred to the NIOSH/NCI mortality study and urged MSHA to forego issuing a regulation until its completion.<sup>34</sup> They also went back to their allies in Congress, lobbying to have the following language included in a 1999 House Appropriations Committee report:

"The Committee believes that the promulgation of a proposed rule on diesel exhaust should be informed by the ongoing NIOSH/NCI study of Lung Cancer and Diesel Exhaust among Non-Metal Miners."<sup>35</sup>

In writing and at public hearings before Department of Labor officials, MARG representatives reported that they were participating cooperatively with NIOSH and NCI researchers on the diesel study and suggested that their group eagerly awaited the study results. These public remarks and written comments neglected to mention their relentless efforts to halt the study.

## Clinton Administration Issues Rule to Protect Miners From DPM

After several years of a public rulemaking process, MSHA issued its DPM rule in January 2001.<sup>36</sup> The agency's quantitative risk assessment described 47 epidemiological studies, with 41 showing some degree of association between occupational exposure to DPM and lung cancer.<sup>37</sup> The estimates of excess lung cancer deaths for a working lifetime at the mean full-shift exposure

level (i.e., 808  $\mu\text{g}/\text{m}^3_{\text{TC}}$ ) ranged from 83 to 800 per 1000 exposed workers.

MSHA's health standard was designed to reduce exposures in underground metal and nonmetal mines to eventually 160  $\mu\text{g}/\text{m}^3_{\text{TC}}$ . At this lower full-shift exposure limit, the agency still estimated at least 15 excess lung cancer deaths per 1000 miners exposed over a working lifetime.<sup>38</sup> In assessing the risk, MSHA acknowledged the importance of the NIOSH/NCI study but asserted that in light of the overwhelming existing evidence of adverse health effects, it could not legally wait for the results.

For both MSHA and OSHA, selecting the appropriate exposure limit is a 2-step process. First, the agency needs to demonstrate that the new health standard will eliminate or reduce a "significant risk," which has been interpreted to mean a cancer risk of 1 in 1000 workers.<sup>39</sup> On the basis of this assessment, the scientific evidence will point to an exposure limit that will protect workers to this threshold.

Step 2, however, drives the decision, as the agencies are required to set an exposure limit that is technologically and economically feasible for the industry as a whole.<sup>40</sup> As a result, in some occupational health standards, there remains a significant risk of harm despite the existence of a workplace regulation.<sup>41</sup> In issuing its 2001 standard, MSHA was explicit that it would not eliminate the significant risk of harm to miners but would simply reduce their exposures to levels comparable to those of other highly exposed groups of workers.

The most protective provisions of the rule established a limit on the concentration of

DPM permitted in miners' underground work environment, specifically an interim exposure limit of 400  $\mu\text{g}/\text{m}^3_{\text{TC}}$  (effective July 2002 through December 2005) and a final limit of 160  $\mu\text{g}/\text{m}^3_{\text{TC}}$  that would take effect in January 2006. MSHA estimated the annual cost to the affected mines would be, on average, \$128 000 per year; an expense less than 1% of annual revenue.<sup>42</sup>

MSHA's rule drew immediate legal challenge from MARG and some mining companies.

## BUSH ADMINISTRATION ACQUIESCES TO INDUSTRY DEMANDS TO DELAY THE RULE

MARG and other mine operators claimed that MSHA's rule was not feasible, and a sympathetic Bush administration capitulated to the industry. MSHA delayed enforcement of the exposure limit and other provisions<sup>43,44</sup> and reopened the rule to propose a number of changes favored by the industry. MSHA also asked for public comment on "an appropriate DPM limit,"<sup>45</sup> signaling its willingness to revisit its determination that the 160  $\mu\text{g}/\text{m}^3_{\text{TC}}$  exposure limit was feasible for the mining industry. The public record was open until late October 2003, and the industry used the opportunity to press for changes that would weaken the existing rule.

## MARG Uses NIOSH/NCI Study to Make Mischief With MSHA's DPM Rule

In early November 2003, while MSHA was reviewing its latest round of public comments, NIOSH and the NCI held a public meeting to discuss the progress of the diesel study. The



audience was composed primarily of representatives of the mining industry, including members of MARG. The government scientists made presentations using PowerPoint slides, but they emphasized that their analyses were incomplete, and notations on the slides stated “information from an incomplete dataset.” Several audience participants requested copies of the visual aids, and NIOSH agreed to provide them. The researchers indicated that the data collection phase of the study was nearly complete and analyses of the data were under way.

Two months after the NIOSH/NCI public meeting, the attorney representing MARG sent an e-mail message to MSHA’s assistant secretary and forwarded a report entitled “Characterization of Lung Cancer in Cohort Studies and a NIOSH Study on Health Effects of Diesel Exhaust in Miners.” The MARG attorney described the report as critically important to the ongoing MSHA’s DPM rulemaking and requested that the rulemaking record be reopened to allow consideration of it. MARG claimed that the report “demonstrates that the initial review of data from the NIOSH study . . . does not show any excess of lung cancers above the expected rate for the general population” (H. Chajet, e-mail to Dave Lauriski, assistant secretary for MSHA, transmitting a copy of a report by Gerald R. Chase, January 5, 2004. Available from author.)

The author did not have the primary study data, but merely extracted numbers from the PowerPoint slides used by NIOSH and NCI researchers at the November 2003 public meeting to generate an “analysis.”

A table was created showing a preliminary count of eligible members of the cohort and an initial count of lung cancer deaths.

As the NIOSH and NCI researchers noted during their presentation, the PowerPoint slides did not include any exposure information (e.g., dose, person-years of exposure) but merely illustrated the government scientists’ progress in obtaining the key data for their analysis. Chase relied on the preliminary count of 231 lung cancer deaths from a preliminary cohort of 2365 miners to conclude that the 9.8% rate of lung cancer deaths could have occurred by chance.<sup>46</sup> To support his conclusion, he compared his percentage calculation to “selected percentages of lung cancer deaths among White males for the US and Wyoming for 1995.”<sup>46</sup>

Unfortunately, epidemiology is more complex. As one worker advocate noted,

“It would be wonderful if Dr. Chase’s methodology could actually produce valid results. We could then avoid all the time and expense of real cohort mortality studies. Just count the death certificates, look up whatever state or county rates support your conclusions, and proceed directly to publication.”<sup>47</sup>

Despite the questionable value of the Chase report, MSHA responded favorably to MARG’s request and reopened the DPM rulemaking record.<sup>48</sup> Representatives of mining interests used the Chase report to repeat their assertions that MSHA’s DPM rule was not based on “sound science.” They asserted that the Chase report

“proves the validity of the [industry’s] earlier comments submitted to the record that

MSHA’s exposure limits were not justified by the agency’s faulty risk assessment, nor by any credible scientific evidence. Dr. Chase’s conclusion supports the urgent need to delete the final 160  $\mu\text{g}/\text{m}^3_{\text{TC}}$  exposure limit” scheduled to take effect in 2006.<sup>49</sup>

MSHA received input from 14 organizations during the comment period, but noticeably absent from the submissions were comments from NIOSH or NCI. The researchers involved in the diesel study may have wanted to prepare a rebuttal; however, under the order issued by the federal district court in June 2001 (order by Richard T. Haik, US district judge, June 5, 2001; available from author), NIOSH would have been required to submit its comments first (and at least 90 days in advance) to the House of Representatives. MSHA’s comment period on the Chase report was only open for 45 days. The government scientists most capable of responding to the MARG-sponsored report were excluded from the process.

### Assaults by MARG Influence MSHA Action, and Miners’ Health Suffers

For nearly a decade, an alliance of mining firms, led by the MARG Diesel Coalition, has employed a variety of tactics to impede scientific research on and public health protections for workers exposed to high levels of DPM. The tactics include the following:

- Using the courts to delay progress on epidemiological studies and to impose unprecedented demands on public health scientists for advance access to data and documents
- Appealing to members of Congress, receiving assistance and

endorsements from legislators for their campaign to oppose health protections for workers

- Using all means to access agency officials to advance their views and reiterate their claims of scientific uncertainty and regulatory infeasibility

MARG success is not without consequence. At some metal and nonmetal mines, in particular those affiliated with MARG, workers are being exposed to extremely high levels of DPM despite a regulation that requires employers to reduce that exposure. At 1 gold mine, full-shift exposures are as high as 994  $\mu\text{g}/\text{m}^3_{\text{TC}}$ .<sup>50</sup> At another, the sample results ranged from 660  $\mu\text{g}/\text{m}^3_{\text{TC}}$  to 1940  $\mu\text{g}/\text{m}^3_{\text{TC}}$ .<sup>51</sup> Although these exposures are well above the permissible level, there is no record of an MSHA citation for these violations. Could it be that MARG’s watchful eye makes MSHA uneasy about enforcing the DPM standard?

At mines not associated with MARG, however, the situation for DPM-exposed miners has improved. A salt mine near Wichita, Kan, for example, has reduced DPM exposures to the 40- to 80- $\mu\text{g}/\text{m}^3_{\text{TC}}$  range, compared with concentrations as high as 700  $\mu\text{g}/\text{m}^3_{\text{TC}}$  when MSHA’s rule first took effect.<sup>52</sup> This mine operator now uses soy-based fuel to run his underground equipment (personal telephone communication with Max Liby, Hutchinson Salt Company, May 12, 2005). Other companies have realized similar success with alternative fuels, filters, ventilation, and new engines.<sup>53</sup>

It has been 10 years since NIOSH/NCI developed the protocol for the miners’ mortality study. MARG succeeded in its

effort to delay progress on the study and will now have an unprecedented opportunity to influence the content and release of the findings. Meanwhile, a legally promulgated DPM standard is on the books but enforced inconsistently by MSHA. The posturing by MARG, some mining companies, and MSHA goes on in air-conditioned offices while underground miners continue to breathe the highest level of diesel exhaust of any workers in the country.

## POSTSCRIPT

In the months since this article was written, MARG continued its efforts to derail health protection for DPM-exposed underground miners. In August 2005, individuals affiliated with MARG met with staff from the White House Office of Management and Budget to discuss MSHA's DPM rule.<sup>54</sup> The details of the conversation are not available to the public. On September 7, 2005, MSHA published a notice in the *Federal Register* proposing to postpone the effective date for the 160- $\mu\text{g}/\text{m}^3$  exposure limit from January 2006 until January 2011.<sup>55</sup> ■

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32. Section 101(a)(6) of the Federal Mine Safety and Health Act of 1977, Public L No. 95–164, 30 USC §811(a)(6) (1977), which is equivalent to §6(b)(5) of the Occupational Safety and Health Act of 1970, 29 USC 655(b)(5) (1970). The Occupational Safety and Health Act's §6(b)(5) also includes the phrase "to the extent feasible" so that it reads "most adequately assures, to the extent feasible, on the basis of the best available evidence." Both sections continue, however, with specific language directing the respective agencies to consider "the feasibility of the standards."
33. Tickner JA, Kriebel D, Wright S. A compass for health: rethinking precaution and its role in science and public health. *Int J Epidemiol*. 2003; 32:489–492. See also: Kriebel D, Tickner J. Reenergizing public health through precaution. *Am J Public Health* 2001;91:1351–1361.
34. Public Hearing before the Mine Safety and Health Administration (MSHA) [November 17, 1998], testimony of Rowdy Heiser, representing FMC Corp and MARG Diesel Coalition. Available at: <http://www.msha.gov/REGS/COMMENTS/DIESEL/981117.pdf>. Accessed December 1, 2005; and public hearing before MSHA [May 11, 1999], testimony of Wes Ing, chairman of the National Mining Association's Metal and Nonmetal Mine Diesel Task Group, and Kent Adamson, representing Solvay Minerals Corp and MARG Diesel Coalition. Available at <http://www.msha.gov/REGS/COMMENTS/DIESEL/990511.pdf>. Accessed December 1, 2005.
35. Department of Labor, Health and Human Services, and Education and Related Agencies Appropriations Bill, 2000, US House of Representatives, Committee Report No. 106–370. Available at: [http://thomas.loc.gov/cgi-bin/cpquery/R?cp106:FLD010:@1\(hr370\)](http://thomas.loc.gov/cgi-bin/cpquery/R?cp106:FLD010:@1(hr370)). Accessed October 18, 2005.
36. Diesel particulate matter exposure of underground metal and nonmetal miners, final rule. 66 *Federal Register* 5706 (2001).
37. Diesel particulate matter exposure of underground metal and nonmetal miners, final rule. 66 *Federal Register* 5752 (2001).
38. Diesel particulate matter exposure of underground metal and nonmetal miners, final rule. 66 *Federal Register* 5853 (2001).
39. *Industrial Union Department v American Petroleum Institute*. 448 US 607 (1980). The Supreme Court specifically stated that its mandate on OSHA to demonstrate a significant risk of harm was not intended as a "mathematical straightjacket" and thus, the Court did not stipulate a specific ratio of unacceptable risk. Instead, the Court provided an illustration: "If, for example, the odds are 1 in a billion that a person will die from cancer by taking a drink of chlorinated water, the risk clearly could not be considered significant. On the other hand, if the odds are 1 in 1000 that regular inhalation of gasoline vapors that are 2 percent benzene will be fatal, a reasonable person might well consider the risk significant and take appropriate steps to decrease or eliminate it."
40. Both the Occupational Safety and Health Act of 1970 and the Mine Act of 1977 require the secretary of labor to consider "the feasibility of the standard," and the matter of economic and technological feasibility of workplace health standards was directly addressed by the Supreme Court in *American Textile Manufacturers Institute v Donovan*, 452 US 490 (1981).
41. For example, OSHA's 1,3-butadiene standard reduced the exposure limit from 5 to 1 ppm. OSHA's quantitative risk assessment noted that the excess risk of cancer at the 1 ppm level ranged from 1.3 to 8.1 per 1000 workers. 61 *Federal Register* 56746 (1996); in OSHA's methylene chloride rule, the new 25-ppm exposure limit estimated a remaining excess cancer risk of 1.7 to 3.62 per 1000. 68 *Federal Register* 1494 (1997); OSHA's 1994 asbestos standard, which reduced the 8-hour time-weighted average permissible exposure limit to 0.1 fiber/cc of air, estimated a remaining excess cancer risk of 3.4 per 1000. 59 *Federal Register* 40964 (1994).
42. Diesel particulate matter exposure of underground metal and nonmetal miners, final rule. 66 *Federal Register* 5884–5899 (2001).
43. Diesel particulate matter exposure of underground metal and nonmetal miners, final rule, stay of effectiveness. 67 *Federal Register* 47296 (2002).
44. *Metal and Nonmetal Interim Diesel Particulate Matter (DPM) Standard Compliance Guide Q&As* (questions 12, 13, 14). Washington, DC: US Department of Labor, Mine Safety and Health Administration; 2003.
45. Diesel particulate matter exposure of underground metal and nonmetal miners, proposed rule. 68 *Federal Register* 48668 (2003).
46. Chase G. Characterizations of Lung Cancer in Cohort Studies and a NIOSH Study on Health Effects of Diesel Exhaust in Miners. Available at: <http://www.msha.gov/01–995/dpmdocs/marg.pdf>. Accessed January 21, 2005.
47. Wright M. Letter to Marvin Nichols, director, Office of Standards, Variances and Regulations, from United Steelworkers of America, providing comment on MSHA's February 20, 2004 *Federal Register* notice, April 5, 2004. Available at: <http://www.msha.gov/regs/comments/03–20190/AB29-COMM-54.pdf>. Accessed January 21, 2005.
48. Diesel particulate matter exposure of underground metal and nonmetal miners, proposed rule, limited reopening of comment period. 69 *Federal Register* 7881 (2004).
49. Sharpe J and Viars B. Letter to Marvin Nichols, director, Office of Standards, Variances and Regulations, from the National Stone, Sand and Gravel Association, providing comment on MSHA's February 20, 2004 *Federal Register* notice, April 5, 2004. Available at: <http://www.msha.gov/regs/comments/03–20190/AB29-COMM-49.pdf>. Accessed January 21, 2005.
50. Newmont Mining Corporation, Carlin East mine, Mine ID No. 2602271. Air samples taken by MSHA inspector in March 2005. MSHA provides access to mine-specific exposure data and other enforcement records at: <http://www.msha.gov/drs/drshome.htm>. Accessed October 15, 2005.
51. Newmont Mining Company, Chukar mine, Mine ID No. 2602481. Air samples taken by MSHA inspector in April 2005. MSHA provides access to mine-specific exposure data and other enforcement records at: <http://www.msha.gov/drs/drshome.htm>. Accessed October 15, 2005.
52. Hutchinson Salt Company, Hutchinson mine, Mine ID No. 1400412. MSHA provides access to mine-specific exposure data and other enforcement records at: <http://www.msha.gov/drs/drshome.htm>. Accessed October 15, 2005.
53. MSHA provides access to mine-specific exposure data and other enforcement records at: <http://www.msha.gov/drs/drshome.htm>. See improvement in DPM exposure at these and other mines using MSHA's data retrieval system, Global Stone, Marble Hill mine, Mine ID No. 0901038; M&M Lime Company, Inc, Mine ID No. 3604403; Martin Marietta, Durham Hill Mine and Mill, Mine ID No. 1301225; Intrepid Potash, Mine ID No. 2900170.
54. The industry representatives were Jim Burrige of FMC Corporation, Bruce Watzman of the National Mining Association, and Henry Chajet of Patton Boggs LLP. A notice about the meeting is posted on OMB's Office of Information and Regulatory Affairs' Web site at: <http://www.whitehouse.gov/omb/oira/1219/meetings/458.html>. Accessed October 14, 2005.
55. Diesel particulate matter exposure of underground metal and nonmetal mines; proposed rule. 70 *Federal Register* 53280 (2005).